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THE PAN-PACIFIC ENTOMOLOGIST

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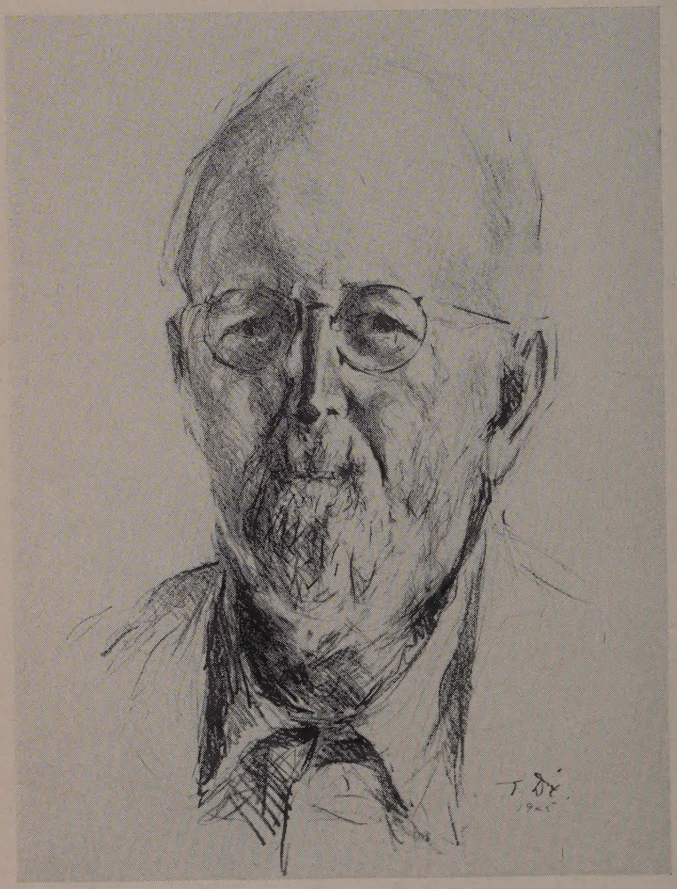

THEODORE DRU ALISON COCKERELL

Crayon portrait by T. Dix at Palm Springs, California, 1945

The Pan-Pacific Entomologist

Vol. XXIV, No. 3 July, 1948

THEODORE DRU ALISON COCKERELL

Theodore Dru Alison Cockerell was born in Norwood, near Croydon, south of London, August 22, 1866, and died at San Diego, California, on the morning of January 26, 1948, at the age of 81 years. He had a stroke several months earlier and passed away quietly at a local hospital. He and Mrs. Cockerell were residing during the winter at 430 Nutmeg Street in that city.

It is difficult short of writing a book, to enumerate even the important events in the life of this great biologist. To list and evaluate his contributions to the knowledge and literature of science and letters and the long and dynamic influence he has exerted upon his students, associates, and the scientific and lay minds throughout the world is hardly possible.

Although he was always a rather frail man and sought health in the mountains of Colorado and New Mexico in early life, yet he was able to master all physical obstacles and to lead a life of exceptional industry, productivity, and longevity.

He came from a splendid family and was educated in private English schools and at the Middlesex Hospital Medical School in London. However, his education was inwardly inspired and was kept constantly aflame by his great interest in many fields of endeavor and in his fellow beings. His extensive travels and the ever loyal assistance of his able wife, Wilmatte Porter Cockerell, contributed continuously to his constantly growing store of knowledge and to the never ceasing output of his pen.

He began his biological career in studying entomology and botany in the Rocky Mountains of Colorado. His first professional position was that of curator of the public museum at Kingston, Jamaica, 1891-1893. His health failing he sought recovery in the Rockies and secured a position as entomologist of the New Mexico Agricultural Experiment Station from 1893 to 1901. He was also in charge of physiology and zoology as a member of the faculty of the New Mexico College of Mechanic Arts. During this period he began intensive studies of the Coccidæ of South and North America, Africa, and other areas, which were continued over a

period of many years. Howard L. McKenzie informs me that in his own bibliography of the Coccidæ there are listed 431 papers by Cockerell which represents a conservative estimate of his writings in this single field. As an illustration of his wide range of publication it is interesting to note that up to 1903, papers on Coccidæ had appeared in Gardeners' Chronicle, Annals and Magazine of Natural History, the Journal of the Trinidad Field Naturalist's Club, Bulletin of the Botanical Department of Jamaica, Science Gossip, American Naturalist, The Industrialist, West American Scientist, Science, Proceedings of the Academy of Natural Sciences of Philadelphia, Canadian Entomologist, The Entomologist, Entomological News, Psyche, Journal of the New York Entomological Society, Journal of Economic Entomology, Proceedings of the Biological Society of Washington, Insect Life, Proceedings of the Eentomological Society of London, Biologia Centrali-Americana, Communications del Museo National de Buenos Aires, La Naturaliza, Victorian Naturalist, Zoe, and others.

Many of these papers were published in co-authorship with other entomologists including C. H. T. Townsend, P. J. Parrott, G. B. King, R. A. Cooley, E. M. Ehrhorn, J. D. Tinsley, Wilmon Newell, and others.

After some time at the Normal School or Normal University at Las Vegas, New Mexico, he returned to Colorado to take charge of the Museum at Colorado College, Colorado Springs. In 1904 he moved to Boulder, Colorado, and lectured at the University of Colorado and in 1906 he joined the faculty of the University as professor of zoology and remained there continuously until he became emeritus professor in 1934. During the early days at Boulder he also lectured at the Colorado Preparatory School where Mrs. Cockerell was teaching.

Nearly always in company with his wife he made a number of collecting and exploration expeditions to many parts of the world. An early trip was made to the Madeira Island in 1879 as a youth with Henry Dru Drury, a descendant of the famous London goldsmith and pioneer entomologist, Dru Drury (1725-1803), from whom he apparently received his second given name. This trip was for his health and on it he made his first scientific observation on "the finest Maderian butterfly" then known as *Pyrameis indica occidentalis* (*Vanessa*). He began his first studies on snails and slugs here. He returned to the Madeira Islands in 1920-21. During this delightful winter he and Mrs. Cockerell visited Porto

Santo, one of the far way islands of this group. His account of that visit is a classic.

The Cockerells went to California in 1901, 1937, 1938, to collect along the southern coast and on the Channel Islands and later to assume charge of the Desert Museum at Palm Springs in March, 1942, and continued until the winter of 1946-1947; to Europe in 1904 and 1920; to Japan, Siam, India, 1923; to Siberia, Australia, 1923, and to the former also in 1927; to Morocco, 1930; to Africa as the Cockerell-Mackie-Ogilvie African Expedition 1931 (collected 16,000 insects); to Canada, Prince Albert Park, 1936; and to Honduras, 1947.

In his early days in Colorado, Professor Cockerell also began the studies on bees which he pursued most energetically throughout the remainder of his life. Many of his expeditions were for the purpose of collecting these insects. The bibliography of his papers on bees must be stupendous. One graduate student, U. N. Lanham, working on the single family Andrenidæ, has listed 1,166 of his papers published on this group between 1888 and 1943. There must be at least 2,000 additional articles on other families.[1] His bee studies encompass much of the world which makes his name familiar to specialists in the bees everywhere.

He also described insects in nearly all the orders.

In Paleoentomology Cockerell was a worthy successor to S. H. Scudder and began his studies of the Florissant fossils of Colorado in 1906. He worked chiefly with the insects and other Arthropoda in Colorado and neighboring states and described numerous insects from the Tertiary (Miocene, Oligicene, Eocene). He also described many genera and species from the collections of the British Museum, 1920; Siberia, 1925; Mongolia, 1927; and Argentina, 1940.

His books in the natural sciences include: Zoology, A Textbook for Colleges and Universities (World Book Co., N. Y. pp. xi + 558, 211 figs.); and Zoology of Colorado, (Univ. of Colorado, Boulder, Colo., pp. vii + 262, illustrated). The textbook was used for years in his University classes. Following the second World War, two thousand copies were distributed throughout Great Britain as a gift by Mrs. Cockerell to her husband's native land—then so hungry for good books. Another thousand is now being

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[1]Norma LeVecque (1948) states that "he published names and descriptions of 5,480 new species and subspecies and 146 names for genera and subgenera by 1938."

given to the devastated libraries of the world—a gift from the author, his wife, and Reese Press. In the back of this book is included his famous poem "The Last Lecture" which gives something of his philosophy and aims in life.

In his numerous publications he rarely included a bibliography, which greatly increases the task of making a fair estimate of his own works which may have appeared previously.

The development of the ornamental red sunflower from a wild source is an example of his affection, interest and help to his wife.[1] The inseparable companionship of Dr. Cockerell and his wife, Wilmatte, whom he married in 1900, has been an inspiration not only to themselves but to their friends and to all these two great souls have come in contact with during the fruitful lives of both of them. Would there were more such luminaries in this world!

In addition to his scientific attainments Professor Cockerell was accomplished in many other fields: as a teacher, in the classroom, in the open country, in museums, in groups of children and adults alike, and as a correspondent and writer, he was always imparting useful and inspiring information.

Although his criticisms of the efforts of others were sometimes exacting and at times rather severe, they were followed by such a kindly interest and continued help that no one could take offense to such an even-tempered and kindly person.

Aside from his teaching, writing, and other academic and professional duties he took time to develop humanistic and literary skills. His literary abilities were expressed in verse, prose, book reviews, letters, travelogues, and lectures. His "Venture in Verse" was published privately in 1927. The many very interesting letters received from his brother, Douglas Cockerell of Letchworth, England, describing the conditions in that country during the late war, he printed and distributed liberally and regularly among his friends and associates over the period 1943-1945.

His series of articles entitled "Recollections of a Naturalist" published in Bios beginning with part I, Vol 6, No. 4, pp. 372-386, 1935, and extending through part VIII, vol. 9, No. 1, pp. 21-25, 1938 afford not only most interesting and instructive reading, but a readily available and authentic source of autobiographical information with very helpful photographs and other illustrative materials.

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[1]Rohwer (1948) has stated that Professor Cockerell had previously married Annie Fenn who bore two sons. The wife died at the birth of the second son and the first son died in infancy, and the second son after his eighth year.

Information has been received through Mrs. Cockerell that the British Museum of Natural History is putting up a plaque to the memory of Professor Cockerell: "world famous naturalist, humanitarian and teacher." His father first took him to the museum when he was a small boy and he has since given specimens of insects and much valuable help to increase the collections and library of that great museum.—E. O. ESSIG, *University of California, Berkeley.*

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THE SUITABILITY OF INSECT-CONDITIONED PLANT TISSUES AS HABITATS FOR SUCCESSIVE INSECT SPECIES

BY RICHARD L. DOUTT[1]

Division of Biological Control, University of California

A phytophagous insect may alter its host in such a manner as to make it particularly suitable for later invasion by another insect species. Examples of such ecological succession are numerous in

---

[1]Junior Entomologist in the Experiment Station.

entomological literature and are especially important considerations in the field of forest entomology. Recent field observations have disclosed two further cases of this type of insect succession which are herein described.

During April, 1947, large numbers of a cicada, *Platypedia* sp., were present in an apple orchard near Sebastopol, California. The characteristic scars on the apple twigs resulting from cicada oviposition were abundant by May 9. On May 22 it was noticed that these scars were providing excellent colony sites for the migrating immature forms of the woolly apple aphid, *Eriosoma lanigerum* (Hausm.). Several of these incipient aphid colonies were tagged and observed throughout the summer season. Although the activities of predaceous coccinellids and syrphids reduced the number of aphids, many of these scar-site colonies persisted through the season. During the winter months they served as hold-over foci from which aphids could disperse in the spring. If this succession is of regular seasonal occurrence it could have economic implications.

Another interesting case of an ecological succession was found during a survey of hymenopterous parasites of the gelechiid, *Gnorimoschema baccharisella* Busck, which forms large oval stem-galls on *Baccharis pilularis consanguinea* Kuntze. The moth vacates the gall through a single small exit hole, and it is through this opening that the gall is often later invaded by crawlers of the black scale, *Saissetia oleae* (Bern.). These crawlers settle on the walls of the gall cavity and are frequently attended by the argentine ant, *Iridomyrmex humilis* Mayr. The scales are protected from their natural enemies by the ants and by the inaccessibility of their feeding site. Occasionally the galls will be invaded by immature mealybugs instead of the black scale crawlers. This has been briefly mentioned by Gillogly (1940) who reports a *Pseudococcus* sp. occuring in *Baccharis* galls formed by other insects. These mealybugs mature, become gravid, and oviposit within the galls for they are protected from their natural enemies by the same factors which shield the scale insects.

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TWO NEW SOUTHWESTERN SPIDER WASPS
(Hymenoptera: Pompilidae)

BY HOWARD E. EVANS
Ithaca, New York

The Pompilid fauna of Southwestern United States is a rich one, and still contains a number of undescribed and sometimes surprising forms. The two species described here belong to the two largest genera of the tribe Pompilini, *Pompilus* and *Anoplius*. Each is, however, quite distinctive within its genus, so much so that it has seemed desirable to name them prior to a more comprehensive review of the group. I am indebted to Mr. Paul D. Hurd, Jr., of the University of California, for his assistance in obtaining much of the material on which these species are based.

Pompilus (Ammosphex) phoenix Evans, new species

This curious species of *Pompilus* is apparently widely distributed in the Southwest. It is not closely allied to any other species known to me; the genitalia, however, in particular, betray a kinship to certain members of the subgenus *Ammosphex*, such as *angularis* (Banks). In general it will fit the characters of this subgenus; it possesses, however, a number of striking specific characters. Chief among these are the following: the penultimate visible sternite of the male is provided with a flattened, specialized median area set off by a carina (Fig. 5); the female possesses a tarsal comb in which there are but two comb-spines on the basitarsus (Fig. 6); the third submarginal cell is very much smaller than the second and usually petiolate; the pulvillar comb is much reduced. Certain other characters will become apparent in the description below. This species is an apparently highly specialized member of an otherwise rather homogeneous genus.

The females of this species have sometimes been considered by Banks as the females of *estellina* Banks; the latter species, however, described from a male, is an *Anoplius*, and not closely related to the present species.

Male. Length 6.5 mm.; fore wing 5.5 mm. Black, body conspicuously brownish and silvery pubescent. The following parts are

clothed with a very dense and rather coarse silvery pubescence: lower half of scape, basal half of mandibles, clypeus, front, temples, pronotum, posterior half of mesonotum, sides of the scutellum, metanotum, postnotum, propodeum, mesopleura, sterna of pro- and mesothorax, coxae, and to some extent the trochanters and femora; very densely sericeous are the first abdominal tergite and bands on the posterior margins of tergites 2, 3, and 4; here and on the pronotum and propodeum there is a median line from which the setulae diverge strongly. Vertex, anterior half of mesonotum, disc of the scutellum, and remainder of the abdomen and appendages with a much finer brownish pubescence. Body devoid of erect hairs, except for a few on the mandibles and a few short, pale hairs on the posterior face of the head and the anterior face of the prothorax. Wings completely hyaline except for broad marginal band on the fore wings.

Head considerably broader than high; eyes very large, front narrow; front in anterior aspect hardly wider than the two eyes taken together. Clypeus twice as broad as high, lower margin truncate. Eyes diverging somewhat above, distance between the eyes at the top 1.2 times the distance between them at the bottom. Front with a distinct line from the antennal bases to the anterior ocellus. Ocelli in a large triangle, forming an acute angle in front; postocellar line greater than ocello-ocular as 3:2. First four antennal segments in a ratio of about 2.6:1:1.8:2, the third segment about 1.8 times as long as thick.

Pronotum much shorter than the mesonotum, posterior margin subangulate; pronotum more or less swollen dorsolaterally and depressed in a narrow band just before the posterior margin. Scutellum prominent, strongly convex. Metapostnotum very broad, as broad medially as the metanotum, finely transversely striate, impressed medially. Propodeum sloping smoothly; spiracles small and close to the anterior margin. Last segment of front tarsus parallel-sided, inner claw rather strongly curved, bifid; outer claw of front tarsus and all remaining claws dentate. The tarsi become very thin distally, the apical segment being much more slender than the basal. Last tarsal segment without spines beneath; pulvillar comb rudimentary.

Cubitus of hind wing arising opposite the tip of the submedian cell. Transverse median vein of fore wing meeting the median slightly beyond the origin of the basal. Stigma very short; marginal cell short, subtriangular, over twice its length from the wingtip. Second submarginal cell about 1.5 times as broad as high, narrowed by about a third above. Third submarginal cell very small, not half the breadth of the second, petiolate above. Third discoidal cell about 1.3 times its length from the margin of the wing; second recurrent vein arising about two-fifths of the way out from the base of the subdiscoidal vein to the margin of the wing.

Abdomen in resting position not longer than the thorax, by virtue of the fact that the apical segments tend to telescope obliquely into

the first three; the subgenital plate and a specialized flattened area on the preceding sternite remain visible apically. The latter sternite is seen, on dissection, to possess an elongate-V-shaped smooth and sparsely setulose area, marked off by a carina, anterior to the apical emargination and running nearly the length of the sternite (Fig. 5). The posterior margin of this sternite on each side of the hooklets bordering the emargination is produced into short, rounded processes. The subgenital plate is subspatulate and nearly flat (Fig. 3).

Genitalia (Fig. 4) with the parameres slender, sparsely hairy, not exceeding the aedeagus. Volsellae with the basal hooklets strong, double, the basal pair the larger; digitus subspatulate, sparsely clothed with short setae, the extreme apex bare. Parapenials short, stout, their inner margins strongly excised opposite the base of the aedeagus. Aedeagus basally broadly expanded, much more slender distad, the extreme apex again expanded, suggesting the tail of a fish. On high magnification several minute teeth can be seen on the margin of the aedeagus subapically; these may be the rudiments of the teeth which occur on the aedeagus of all members of the subgenus *Ammosphex*, but in no other Pompilini known to me.

A single male paratype agrees closely with the type. It is smaller (5.5 mm. long); the basal and transverse median veins of the fore wing are interstitial. The head of this specimen is partially eaten by Dermestids.

Female. Length 9.5 mm.; fore wing 8.5 mm. Black; entire body clothed with a fine, somewhat velvety brownish-cinereous pubescence; part of the lower front and spots on the sides of the scutellum and metanotum are silvery-sericeous. Front wings brownish, the margin with a darker band, strongly violaceous; hind wings subhyaline basally, more heavily infuscated toward the apex. Body with only a very few erect hairs as in the male.

Head broader than high; eyes large and front narrow. Front, in anterior aspect, not wider than the two eyes together; inner orbits subparallel. Clypeus three times as broad as high, truncate below. Labrum mostly concealed, the apical margin with a median notch. Mandibles with a single tooth on the inner margin. Median line of front distinctly impressed. Ocelli in a large triangle, the laterals much nearer to the eyes than one another. Antennae long and slender; first four segments in a ratio of about 3:1:4:3, the third segment subequal to the distance between the eyes on the vertex.

Thorax similar to that of the male; metapostnotum nearly as long as the metanotum, finely transversely striate. Propodeum short, subglobose, sloping more steeply behind, the declivity slightly concave. Median line of propodeum distinctly impressed above; spiracles not their length from the anterior margin. Front tarsus (Fig. 6) wth a comb, the spines of which are about twice as long as the width of the tarsus. There are two comb-spines on the basitarsus, the apical one about two-thirds as long as the second segment; there are two comb-spines on the second segment and a single smaller spine on the third. Tarsi becoming more slender apically, as in the

male; pulvillar comb rudimentary; last tarsal segment with two or three spines beneath near the base, the apical half without spines. Venation not differing from that of the male. Abdomen short and stout, tapering rapidly behind; entire abdomen devoid of erect hairs or bristles.

Seven female paratypes vary in size from 5.5 to 10.5 mm., a considerable range. The smaller specimens have a relatively broader front and shorter antennae; the third antennal segment in the smallest specimen is equal to but .65 times the distance between the eyes on the vertex. The spines of the tarsal comb may be very short, not longer than the width of the tarsus. In one specimen the third submarginal cell is not petiolate, nor even triangular, but is at least much smaller than the second.

Holotype. ♂; ARIZONA, MARICOPA COUNTY, PHOENIX, July 11, 1932. *Allotype.* ♂; CALIFORNIA, IMPERIAL COUNTY, PALO VERDE, August 20, 1946 (P. D. Hurd). *Paratypes.* ♂; California, Contra Costa County, Antioch, September 10, 1947 (J. W. MacSwain). [These three specimens are from the collection of the California Insect Survey; the specimens will be deposited in the California Academy of Science.] ♂; California, Inyo County, Independence, June 7, 1939 (R. M. Bohart). ♀; California, Fresno County, Coalinga, July 18, 1946 (P. D. Hurd). [These two specimens, also from the California Insect Survey, will be deposited in the U. S. National Museum.] ♂; California, Calaveras County, Mokelumne Hill, October (F. E. Blaisdell) [Calif. Academy of Science]. ♀; California, Kings County, Lemoore, August 6, 1927 [Cornell Univ.]. ♀; California, San Diego County, National City, May 15 (Van Duzee) [Mus. Comp. Zool.]. ♀; UTAH, San Juan County, Bluff, July 7, 1935 (C. T. Brues) [Mus. Comp. Zool.]. ♀ TEXAS, Jeff Davis County, Fort Davis, July 26, 1946 (H. E. Evans) [Cornell Univ.].

EXPLANATION OF FIGURES

Anoplius (*Pompilinus*) *californiae* Evans, new species: Fig. 1, Subgenital plate (sternites VIII and IX) of male; Fig. 2, Male genitalia; Fig. 7. Front tarsus of female. *Pompilus* (*Ammosphex*) *phoenix* Evans, new species: Fig. 3, Subgenital plate (sternites VIII and IX) of male; Fig. 4, Male genitalia; Fig. 5, Sternite VII of male; Fig. 6, Front tarsus of female. In the figures of the genitalia, the ventral view is drawn on the left side, the dorsal on the right.

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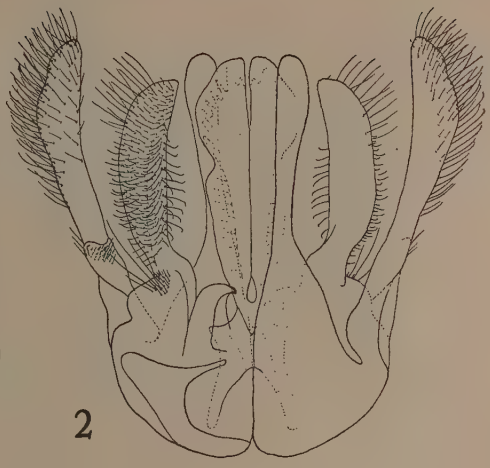
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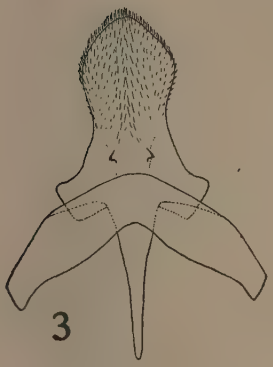
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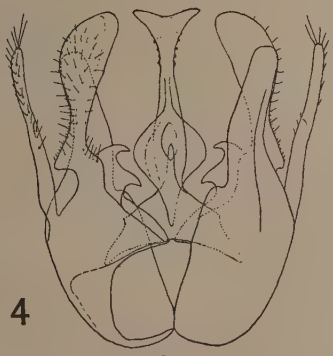
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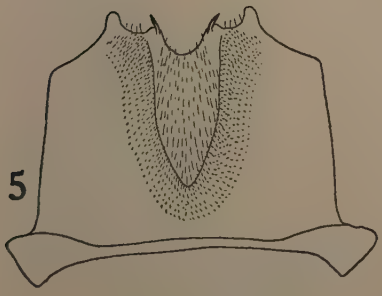
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Anoplius (Pompilinus) californiae Evans, new species

This new member of the very homogeneous subgenus *Pompilinus* is fortunately provided with a number of specific characters which set it apart without great difficulty from its congeners. The tarsal comb of the female is more strongly developed than in other native species of the subgenus except *brevihirtus* (Banks); from the latter it differs in being much larger, all black, less hairy, and in the relatively longer antennae, narrower front, etc. In the hairiness of the propodeum it resembles *tenebrosus* (Cresson), but the stronger tarsal comb serves to separate it from this species. The male is separable on the characteristic subgenital plate and genitalia, as well as in the hairiness of the propodeum.

Female. Length 10 mm.; fore wing 8 mm. Black; apical two-thirds of the mandibles dull ferruginous. Body clothed with a very fine brownish pubescence. Wings fuliginous, somewhat violaceous. Body with erect dark hairs as follows: clypeus, front, vertex, temples, prosternum rather densely; scape slightly hairy below; entire thorax including the coxae and propodeum, with rather sparse but prominent erect hairs; abdominal venter somewhat hairy, especially caudad; apical tergite with numerous stout, bristly setae.

Head, exclusive of mouthparts, 1.2 times as broad as high. Mandibles with a single tooth on the inner margin. Labrum slightly exserted, apical margin truncate, bristly. Clypeus 2.5 times as broad as high, apical margin truncate. Front broad; distance between the eyes at the emargination of the orbits .6 times the width of the head. Eyes converging but very slightly above, the inner orbits nearly parallel. Ocelli in approximately a right triangle; postocellar line greater than ocello-ocular as 5:4. Antennae quite long and slender, the first four segments in a ratio of about 3.5:1:4.5:3.5, the third segment equal to about three-quarters the distance between the eyes on the vertex.

Posterior margin of prothorax angulate, although not sharply so. Metapostnotum a narrow transverse band, about one-third the width of the metanotum, transversely striate. Propodeum strongly swollen, with a well defined flat or slightly concave declivity, median line scarcely impressed. Anterior tarsus (Fig. 7) with a well developed comb of spines nearly twice as long as the width of the tarsus; there are four on the basitarsus, the apical one over half the length of the second tarsal segment. Last tarsal segment with 3 or 4 median spines beneath; pulvillar comb strongly developed.

Anal and cubital veins of hind wing interstitial on the medius. Transverse median of fore wing meeting the median slightly distad of the base of the basal vein. Marginal cell about 1.5 times its length from the wing-tip, radial vein angled at the second transverse cubital. Second submarginal cell rhomboidal, somewhat broader

than high. Third submarginal cell about as broad as high, petiolate above.

The six female paratypes vary in size from 9 to 12.5 mm. In two specimens there are but three comb-spines on the basitarsus of the same length as in those with four. The hairiness of the body is somewhat variable, and in one specimen the femora bear numerous erect hairs. In most of the paratypes the anal vein of the hind wing meets the median before the origin of the cubitus.

Male. Length 9.5 mm.; fore wing 8 mm. Black; pubescence brown, except on the sides of the clypeus and lower face, and on the temples, where it is conspicuously silvery. Fore wings fuscous, slightly darker along the margin; hind wings subfuscous, darker apically. Scape slightly hairy below; clypeus, front, vertex, temples, and prosternum with short erect hairs in abundance; entire thorax, including the front coxae and the propodeum, with more sparse but prominent hairs; abdomen smooth, without erect hairs.

Head, exclusive of mouthparts, 1.15 times as broad as high. Clypeus truncate below, 2.25 times as broad as high. Front quite broad, at the middle .6 times the breadth of the head. Eyes diverging very slightly above. Ocelli quite large, forming an acute angle in front; postocellar line greater than ocello-ocular as 8:7. Antennae quite long and slender, first four segments in a ratio of about 3:1:3:3, third segment about 2.8 times as long as thick.

Pronotum angulate behind. Metapostnotum about half as wide as metanotum, finely transversely striate, it and the propodeum with an impressed median line. Propodeum swollen, more steeply declivous behind. Last segment of anterior tarsus asymmetrical, the inner margin produced; inner claw of front tarsus strongly curved, the outer less strongly curved but more so than the claws of the middle and hind tarsi; all the claws bifid. Last tarsal segment not spined beneath. Venation as in the female; anal vein of hind wing meeting the medius before the origin of the cubitus.

Abdomen rather stout, subfusiform. Penultimate visible sternite with a large U-shaped emargination. Subgenital plate (Fig. 1) rather broad, nearly flat, but with the median line slightly raised. Genitalia (Fig. 2) with the parameres the longest of the appendages, expanded and very slightly curved apically; basis volsellaris with the hooklets single and strong, at the base of the digitus with numerous short and several long hairs; digitus quite long, nearly parallel-sided, acutely pointed, beset with short setae which are longer on the upper, outer part; parapenials simple, nearly as long as the parameres, subequal in length to the adeagus; adeagus gradually expanded toward the apex, which is quite broad, but margins notched about two-thirds way out. The genitalia, while possessing numerous specfic characters, are of the general pattern of those of the subgenotype, *cylindricus* (Cresson). They closely resemble those of *estellina* (Banks), which occurs in the same area, except that the

aedeagus is very different in shape; this species is also much smaller than *californiae*.

Holotype. ♀; Baja California, Mexico, La Paz, June 3, 1921 (E. P. Van Duzee). *Allotype*. ♂; same data as holotype. [These two specimens will be deposited in the California Academy of Science.] *Paratypes*. ♀; Gulf of California, Mexico, Angeles Bay, May 7, 1921 (E. P. Van Duzee [U. S. National Museum]. ♀; CALIFORNIA, Inyo County, Owens Lake, June 2, 1937 (N. W. Frazier) [Cornell Univ.]. 2 ♀♀; California, San Bernardino County, 29 Palms, Boyer Ranch (M. Boyer) [Mus. Comp. Zool.]. ♀; ARIZONA, Pinal County, Florence, May 1903 [Acad. Nat. Sci. Phila.]. ♀; "Arizona" [U. S. National Museum]. The last two listed are in poor condition.

Book Notice

The Naturalist's Lexicon, a List of Classical Greek and Latin Words used or suitable for use in Biological Nomenclature, with abridged English-Classical Supplement. By Robert S. Woods. Abbey Garden Press, P. O. Box 101, Pasadena, Calif. xvii + 282 p. 1944. Price $2.75.

The Introduction of this attractively-bound book includes sections on the construction of names, terminations (with tables of Latin adjectival endings and Greek noun endings), formation of nouns, adjectives and participles, diminutives, compound words, generic and specific words, and pronunciation. Pronunciation is indicated for each word listed in the body of the work, and although the list is not as long as that in Jaeger's "A Source-book of biological Names and Terms" (C. C. Thomas, 1944. $3.50), there are here many words not in the latter, and they make fine companion pieces. The English-Classical section (p. 259-282) is classified and helpful to persons wishing to coin appropriate scientific names.

In 1947 the Abbey Garden Press published a 47-page "Addenda to the Naturalist's Lexicon," by the same author, price 25 cents. It contains a comprehensive classified English-Classical key to the descriptive nouns, adjectives and verbs in the Lexicon, as well as some additions and emendations to the latter. This Addenda is comparable, in its usefulness, to the dictionary form of Roget's Thesaurus, and as in the main work the typography is clear and legible.—Hugh B. Leech.

THE CAVICOLLIS-CORNEUS GROUP OF PODABRUS
(Coleoptera: Cantharidae)

BY KENNETH FENDER
McMinnville, Oregon

The *cavicollis-corneus* group of the genus *Podabrus* Westwood is composed of those species that have the outer claws of the hind feet toothed and all other claws cleft in the males, all claws toothed in the females. As is so frequently true of many insect groups, females of *Podabrus* are often difficult if not impossible to place if unaccompanied by males.

As this is an attempt to straighten out the *cavicollis* and *corneus* as they were understood by Fall, it has been deemed advisable to redescribe these species, neither of which was adequately described by either LeConte or Fall. Several hundred specimens have been examined for this study and the comparisons of male genitalia with color and other external characters indicate that these characters are reliable for specific and subspecific determination.

Both LeConte and Fall made note of species of *Podabrus* in which the elytra were dark with the suture pale. They both failed to remark on the dark suture of some of the species with pale elytra. Many of the western pale species do have the suture dark. This characteristic is present in all of the specimens of the *cavicollis* section examined from California, the region from which the type of this species was taken.

Thanks are due Dr. E. S. Ross of the California Academy of Sciences for the loan of the fine series of the Academy collection; to Mr. G. Stace Smith of Creston, B.C.; Dr. Melville H. Hatch of the University of Washington; Mr. G. P. Mackenzie, San Marino, Calif.; Mr. W. F. Barr and Mr. K. S. Hagen of the University of California.

KEY TO SPECIES

Outer claw of hind tarsi of male toothed, all others cleft; all claws toothed in the female.

A. Second and third antennal segments equal.
B. Pronotum very finely, sparsely punctured; median impressed pronotal line obscurely indicated.
C. Pronotum entirely pale.....californicus
CC. Pronotum brunneus with sides pale.....lucidatus
BB. Pronotum coarsely punctured, median impressed line plainly indicated.
D. Pronotum entirely pale.
E. Elytral suture darker; head usually black behind the eyes .....lutosus
EE. Elytra and head entirely pale.....smithi
DD. Pronotum pale with the discal excavation black.
F. Basal margin of the pronotum, when viewed from directly above, slightly convex with a shallow indentation medially. .....cavicollis
1. elytra pale with the suture black.....typical form
2. elytra pale with the suture and discal striae dark..... .....subsp. albrighti
3. elytra black or at best with the outer margins very narrowly pale.....subsp. hatchi
FF. Basal margin of pronotum, when viewed from directly above, very evidently concave.....carmelensis
AA. Second antennal segment conspicuously shorter than the third.
G. Front angles of pronotum oblique; median impressed line present.....rossi
GG. Front angles of pronotum rounded; no median impressed line .....corneus

Podabrus carmelensis Fender, new species

Head black posteriorly, yellow in front of the eyes; antennae piceous, first two segments and basal half of the third segment pale; palpi pale with the apices of the last segments darker. Pronotum pale brownish yellow with the discal concavity dark brunneus, a narrow pale space in the middle of the dark area. Scutellum piceous. Elytra yellow with the suture narrowly dark. Under side of head black behind with the mouth parts pale; prothorax pale beneath. Ventral abdominal segments piceous with the margins and apices pale, the median surface of the last two segments pale. Front and middle femora and tibiae dark above and pale beneath, the tarsi dark. Hind legs dark with the apical half of the coxae, the trochanters, the basal third of the femora pale yellow. Length 6-7 mm.

Male. Head wider than thorax, finely sparsely punctate in front of the eyes, coarsely more closely so behind; second and third antennal segments equal. Pronotum quadrate, anterior angles oblique, sides angulately arcuately converging slightly to the hind angles which are prominent, the basal margin when viewed from directly

above evidently concave; coarsely rather sparsely punctured, median impressed line not eroded, interrupted apically and basally. Elytra finely punctured basally becoming rugose apically. Outer claws of hind legs toothed, all others cleft.

Female. Unknown.

Holotype: male, No. 5901, (Calif. Acad. Sci., Ent.) Carmel, Monterey Conuty, Calif., March 24, 1919, collected by E. P. Van Duzee.

Paratypes: two males, same data as the type save that one was collected on March 25, 1919.

This species may be separated from *P. cavicollis* by the concave basal margin of the pronotum. Superficially it resembles *P. cavicollis* but the genitalia indicate a much closer relation with *P. californica* and *P. lucidatus*.

Podabrus californicus Fender, new species

Shining. Head black posteriorly, yellow in front of eyes; antennae piceous, basal two or three segments pale; pronotum pale brownish yellow; scutellum black; elytra pale, suture narrowly dark brown and the apices dusky; body beneath black, prothorax, front half of head, apices and sides of ventral abdominal segments, and legs pale, the hind legs becoming dusky apically; pubescence cinereous. Length 6 to 7.5 mm.

Male. Head finely sparsely punctate in front of the eyes, coarsely punctured behind, the latter punctures sparse near the eyes, becoming more closely so posteriorly. Antennae stout, the second and third segments equal and each twice as long as wide. Pronotum transverse, narrower than the head, anterior angles oblique, sides nearly straight, converging slightly to the hind angles which are prominent; feebly sparsely punctured; area between the convexities very shallowly impressed; median impressed line feebly indicated, usually very short. Elytra sparsely, finely punctate basally, becoming rugose-punctate apically. Pubescence short and recumbent. Body beneath finely punctate, pubescence short and rather sparse. Outer claws of hind feet toothed, all other cleft.

Female. Similar to male. Head narrower, slightly wider than the pronotum; antennae shorter, segments comparatively stubbier; all claws toothed.

Holotype: male, No. 5902 (Calif. Acad. Sci., Ent.) Big Bend Mt., Butte County, Calif., V-8-28, collected by H. H. Keifer. Allotype: female, No. 5903 (Calif. Acad. Sci., Ent.) same data as type. Paratypes: 16 males and 15 females from the following California localities: Big Bend Mt., Butte County; Meadow Valley, Plumas

County; Truckee; Yankee Hill, Butte County; McKinneys, Eldorado County; Pinnacles Nat. Park; Carmel; Oroville; Mt. St. Helens; Mt. Wilson; Keddie, Plumas County; Mariposa.

Podabrus californicus may be confused with *P. lutosus*, *P. smithi*, *P. rossi* or *P. corneus* but only upon superficial examination. The very finely, sparsely punctured pronotum separates it at once from the first two and the equal second and third antennal segments isolates it from the last two.

Podabrus lucidatus Fender, new species

Head black behind, flavous in front of eyes, apical half of clypeus brunneous. Palpi pale, apices of the last segments brownish black. Antennae piceous, the first two segments and the basal half of the third segment pale. Pronotum brownish yellow, the discal concavity dark brunneous, the edges of this dark area diffuse. Elytra ochreous, the base and suture narrowly infuscate; a diffuse vitta extending from the shoulders to the apices, expanding to nearly the full elytral width at the apices. Body beneath black, head in front, and thorax pale, apices of the ventral abdominal segments narrowly paler. Legs dark brown with the joints of the hind and middle legs narrowly and of the front legs widely pale. Length 5.5 to 6.5 mm.

Male. Head finely, sparsely punctate in front of constriction of neck, coarsely punctured behind. Eyes prominent, head wider than pronotum. Antennae stout, medium long, attaining the middle of the elytra; segments 2 and 3 subequal, each twice as long as wide. Pronotum similar to *P. californicus* but sub-quadrate and the hind angles somewhat more prominent. Elytra, under side and legs similar to those of *P. californicus*. Outer claws of hind legs toothed, all others cleft.

Female. Similar to the male but with head only slightly wider than pronotum and the hind angles of the pronotum are not so prominent. All claws toothed.

Holotype: male, No. 5904 (Calif. Acad. Sci., Ent.) Fallen Leaf, Eldorado County, Calif., VII-14-35, Alt. 6500 feet, collected by F. E. Blaisdell. Allotype: female, Chester, Cal., VI-12-41, collected by D. J. and J. N. Knull; in the Knull collection. Paratypes: one female, same data as allotype; two males and two females, W. Walker River, Calif., VI-11-41, D. J. and J. N. Knull.

There is very little variation in the series at hand. This species is quite similar exteriorly to *Podabrus californicus*, being most easily separated by the bicolored pronotum. The median hooks of the tegmen are much larger than in that species and are more

abruptly curved. It should not be confused with any of the other species with the pronotum bicolored in this group. The nearly impunctate, shallowly excavated pronotum will permit easy recognition.

Podabrus lutosus LeConte

Podabrus lutosus LeConte, 1881, Trans. Am. Ent. Soc., 9:48.
Podabrus cavicollis, Fall, 1928, Entom. Amer., 8:102.

Head black behind the eyes, brownish yellow in front. Palpi orange with the apical half of last segment brunneus. Antennæ piceous with the basal two segments brownish yellow. Pronotum orange. Scutellum black. Elytra golden yellow with the suture narrowly brown to black, apices more or less dusky. Under side black; prothorax, head beneath, coxae, trochanters and narrow apices of ventral abdominal segments pale. Legs dark above and pale beneath.

Male. Head wider than thorax; coarsely, rather closely punctate behind the constriction of neck; becoming more finely, sparsely so anteriorly. Antennae rather long, reaching to apical third of elytra; second and third antennal segments equal, two and a half times as long as wide. Pronotum shining, transversely quadrate, the front angles oblique; the sides somewhat angularly sinuate to the hind angles which are prominent; coarsely punctate, the median excavation deep; median impressed line eroded, extending from base to apical fourth. Elytra finely sparsely punctured basally, becoming rugose punctate apically. Vestiture fine, suberect and rather sparse above; recumbent, short and close beneath. Outer claws of hind legs toothed, all others cleft.

Female. Similar to male but with eyes less prominent and head only slightly wider than pronotum; antennae shorter, reaching midway on the elytra. All claws toothed.

Specimens have been examined from the following localities, all California: Lake Tahoe, Big Bent Mt., Butte County; Meadow Valley, Plumas County; Truckee; Yankee Hill, Butte County; McKinneys, Eldorado County; Pinnacles Nat. Park; Carmel; Oroville; Mt. St. Helena; Adams Springs, Lake County; Santa Cruz Mts.; Hills back of Oakland; Cazadero; Yosemite Valley; Leona Heights, Alameda County; Mokelumne Hill; Fairfax, Marin County; Ontario Hot Springs, San Luis Obispo County; Muir Woods, Marin County; Lagunitas, Marin County; Dimond, Alameda County; Atascadero, San Luis Obispo County; Cypress Ridge, Marin County; Mill Valley, Marin County; Paraiso Hot Springs; Mt. Tamalpais, Marin County; Pismo; Moraga Valley,

Contra Costa County; Berkeley; Forest Glen; Claremont; Cupertino, Santa Clara County.

This species was included with *P. cavicollis* by Fall. It can be separated from that species by its unicolorous pronotum. Several pairs of both species have been seen which were taken in coitu. In none of these instances has a male of one species been found mating with a female of the other species. On this basis and some differences in the male genitalia it is considered advisable to describe this as a good species. The species centers around the San Francisco Bay region and the Sacramento Valley.

Podabrus smithi Fender, new species

Podabrus cavicollis Fender (in part), 1945, Pan-Pac. Ent., 21:80.

Brownish orange; eyes, apical halves of last segments of palpi and body beneath black; ventral abdominal segments dark brown with sides and apices of segments rather widely pale. Head proper, antennae, pronotum, scutellum, elytra and legs entirely pale. Pubescense cinereous. Length 6 to 8 mm.

Male. Eyes large. Head wider than pronotum, finely sparsely punctate in front, more coarsely punctured behind; with a rugose area between the eyes. Antennae medium in length, reaching to one-half the elytral length; second and third segments equal. Pronotum shining, elongate-quadrate; the anterior angles rounded; sides rounded to near the base where they become sinuate; hind angles nearly forming right angles, scarcely prominent; surface coarsely punctate, more finely so in the discal excavation; median impressed line deeply, widely eroded. Elytra finely sparsely punctured basally, becoming rugose apically. Pubescense fine and sparse. Outer claws of hind feet toothed, all other cleft.

Female. Similar to male but eyes smaller, head equally as wide as pronotum which is subquadrate. Antennae shorter, reaching to basal third of elytra. All claws toothed.

Holotype: male, Lewis Peak, Blue Mts., Wash., VI-20-41, collected by K. M. and D. M. Fender. Allotype: Female, Durkee, Ore., VI-17-41, collected by K. M. and D. M. Fender. Paratypes: 9 males and 27 females from the following localities: British Columbia—Creston, Sanca, Wynndel; Washington—Lewis Peak in the Blue Mts., Kooskooskie; Oregon—Wallowa Lake, Durkee.

This species is dedicated to Mr. G. Stace Smith of Creston, B. C., whose excellent series of the species so strongly augmented the few possessed by the describer. *Podabrus smithi* is confined to the northern Rocky Mountains and their offshoots, the Blue Mountains

of Washington and Oregon. It can be separated readily from allied species by its concolorous upper surface and legs. The elytral suture is not dark as in the other members of the section with the second and third antennal segments equal. Singleton females of this species were recorded as *P. cavicollis* from La Grande, Wash., and the Blue Mts., Ore.[1]

PODABRUS CAVICOLLIS subsp. CAVICOLLIS LeConte

Podabrus cavicollis LeConte, 1851, Proc. Ac. N. S. Phila., 5:345.
Podabrus cavicollis LeConte, 1881, Trans. Am. Ent. Soc. 9:50.
Podabrus cavicollis, Fall (in part), 1928, Ent. Am., 8:102.
Podabrus cavicollis, Fender (in part), 1945, Pan-Pac. Ent., 21:80.

Head yellow, the tip of the clypeus brunneous, a black chevron, extending backward from the eyes, the point of chevron at base of constriction of neck. Antennae piceous with the basal two segments pale; palpi pale with apical two-thirds of last segment of maxillary and last segment of labial palpi black. Pronotum brownish yellow, the hind angles becoming pale yellow, the discal excavation black. Scutellum black. Elytra grayish yellow becoming dusky apically, the suture narrowly black. Body beneath black, the head, prothorax and apices of ventral abdominal segments pale. Anterior legs dark above, pale beneath. Middle and hind legs black with apices and pale. Pubescence cinereous. Length 6 to 8 mm.
bases of femora and tibiae and apices of coxae pale, trochanters

Male. Head wider than pronotum, finely, sparsely punctate in front of eyes, coarsely punctured behind; antennae reaching to apical third of elytra, second segment equal to third. Pronotum sub-quadrate, the anterior angles oblique, sides more or less straight, converging slightly to hind angles which are slightly prominent, basal margin when viewed from directly above, slightly convex with a shallow indentation medially; rather closely punctured, more closely so anteriorly, the base of excavation rugose, median impressed line eroded. Elytra sparsely punctured basally, becoming somewhat rugose apically. Outer claw of hind legs toothed, all others cleft.

Female. Similar to the male but with antennae shorter and all claws toothed.

Material has been seen from the following localities: British Columbia—Nanaimo, Duncan, Glen Lake, Creston, Vernon; Washington—Seattle, Kirkland, Quillayute, Nasel River, Olympic Hot Springs, Mount Rainier, Skye; Oregon—Portland, McMinnville,

[1]Pan-Pac. Ent., 21:80, 1945

Boyer, Dayton, Sandlake, Sisters, Depoe Bay, Muddy Valley in Yamhill County, Astoria, Little Nestucca River, Baker Creek in Yamhill County, Mount Hood, Olney, Newport, Cannon Beach, Waldport, Marshfield, Siskiyou Summit; California—Fairfax, Oakland Hills, Fallen Leaf Lake, Mokelumne Hill, Santa Cruz, Yorkville, Meadow Valley in Plumas County, Angora, Mad River Mts., Redding, Shasta Meadows, Siskiyou Mts., Sand Flat in Sonoma County.

This is a variable species and the most widely distributed of the group. It may be distinguished from the allied species by the points given in the key. Specimens from British Columbia tend to be darker and larger with the pronotal punctures much coarser, sometimes becoming rugose punctate. Those from the Oregon Coast have a tendency for the pale areas to be unusually pale, the sutural stripe to be more prominently dark and the pronotal spot to extend beyond the limitations of the median excavation. More southern examples and those of the Willamette Valley are more nearly typical. In some specimens the pronotal black spot is confined to the basal portion of the pronotal excavation. In each of these instances these variations are not sufficiently constant to warrant subspecific designation. The two subspecies noted were of adequate constancy in their regions to justify naming.

Podabrus cavicollis albrighti Fender, new subspecies

This subspecies, in addition to the black sutural stripe, has a dark vitta on each elytron that extends from the humerus to the apex, usually expanding to the elytral width as it nears the apex. The pronotal spot extends from the base to the apex and spreads out laterally at the extremities of the pronotal concavities. To date it has been taken in very restricted spots. In only one of these spots has typical *cavicollis* been taken.

Holotype: male, Bear Springs, Wapinitia cut-off, Ore., VI-6-39, collected by K. M. and D. M. Fender. Allotype: female same data as the type. Paratypes: 12 males and 15 females collected at Bear Springs, Wapinitia cut-off, Ore., and Clackamas Lake, Ore. It appears to be confined to the Cascade Range.

This subspecies is dedicated to Mr. Ray Albright of Dayton, Oregon.

PODABRUS CAVICOLLIS HATCHI Fender

Podabrus cavicollis var. *hatchi* Fender, 1945, Pan-Pac. Ent., 21:80.

This subspecies has the elytra entirely black or only the elytral margins very narrowly pale. The black discal spot does not tend to extend laterally around the extremities of the convexities as it does in the subsp. *albrighti*. It has been taken in fair abundance only at Spencers Butte, Eugene, Oregon. The type locality is LaGrande, Wash. Other localities are Clackamas Lake, Ore., Boyer, Ore., and Marshfield, Ore.

Podabrus rossi Fender, new species

Head orange in front of eyes, black behind; antennae brunneous with basal two or three segments paler beneath; palpi pale with apical two-thirds or last segment brunneous. Pronotum orange. Elytra pale brownish yellow, becoming dusky near apex, the suture narrowly brown. Body beneath black with prothorax and mouth parts pale, the sides and apices of ventral abdominal segments very narrowly pale. Legs black with all joints more or less widely pale. Pubescense cinereous. Length 7.5-8.5 mm.

Male. Head finely sparsely punctate in front of eyes, very closely coarsely so behind, in spots becoming rugose punctate; eyes mildly prominent; second antennal segment evidently shorter than third. Pronotum finely sparsely punctate, scarcely narrower than head; front angles oblique, the sides subsinuate to hind angles which are prominent; median impressed line not eroded. Elytra finely punctate basally, becoming rugose punctate apically. Outer claws of hind feet toothed, all others cleft.

Female unknown or unrecognized in the material available.

Holotype: male, No. 5905 (Calif. Acad. Sci., Ent.) Yankee Hill, Butte County, Calif., V-8-28, collected by H. H. Keifer. Paratypes: four males from the following California localities: Yankee Hill, Tallac, Yosemite Valley and Mokelumne Hill.

Podabrus rossi and *P. corneus* may be separated from the rest of the group by the very short second antennal segments. The female of *P. rossi* will no doubt have the antennal segments similar but will doubtless have all tarsal claws toothed as do the other females.

PODABRUS CORNEUS LeConte

Podabrus corneus LeConte, 1861, Proc. Ac. N. S. Phila., 350.
Podabrus corneus LeConte, 1881, Trans. Am. Ent. Soc. 9:49.
Podabrus corneus, Fall, 1928, Ent. Am. 8:102-103.

Head yellowish orange in front of eyes, black behind; antennae piceous with basal two segments pale beneath; palpi pale with last segment piceous. Pronotum brownish yellow on disc, becoming clear yellowish at sides. Scutellum black. Elytra yellow with tips becoming narrowly dusky. Body black beneath with mouth parts, thorax and sides and apices of ventral abdominal segments pale. Legs black with apical third of femora pale. the front tibiae and basal fifth of middle and hind tibiae pale. Pubescense cinereous. Length 8.5-9 mm.

Male. Head rather small, as wide as pronotum, feebly sparsely punctate in front of eyes, coarsely punctate behind; antennae long, reaching to apical third of elytra, second segment evidently shorter than third. Pronotum transverse, the anterior angles rounded, the sides evenly rounded to hind angles which are prominent; feebly sparsely punctured; without a median impressed line. Elytra finely punctured basally, becoming rugose punctate apically. Outer claws of hind legs toothed, all others cleft.

Female. Similar to male but with antennae shorter, head slightly narrower than pronotum and all tarsal claws toothed.

All of the material examined was collected in the Sequoia National Forest, California.

The eyes of *P. corneus* are not as prominent as are those in *P. rossi*. The pronotum with sides rounded and with no median impressed line separates this species from *P. rossi*. The second antennal segment evidently shorter than the third isolates it from the remaining species of the group.

Unless otherwise stated, types are for the present in the author's collection.

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TWO NEW SPECIES OF NEOKOLLA CLOSELY RELATED TO GOTHICA

(Homoptera: Cicadellidæ)

BY DWIGHT M. DELONG
Ohio State University

For many years collections of North American leafhoppers have contained a series of specimens under the name *Neokolla gothica* which were variable in size and coloration. It was necessary for the work of Dr. H. H. P. Severin* upon insect vectors of virus plant diseases to focus attention upon the western specimens and thus reveal the fact that the common species on the west coast is distinct from the common eastern form. In attempting to find the range of the western species a third one was found to occur in Arizona. The California species is being described as *severini* and the Arizona species as *aridella.*

NEOKOLLA GOTHICA (Sign.)

Tettigonia Gothica Signoret, 1854, Ann. Ent. Soc. Fr. p. 345.

The vertex of *gothica* is bluntly produced, about three fourths as long at the middle as the basal width between the eyes. Length 5.5 to 6.5 mm.

Color yellowish to gray, often reddish, with black markings on the vertex in the form of two "horseshoes" with the open end basally. These are on the basal half of the vertex. There is a black spot at apex and a black line either side enclosing the reflexed portions. A black line entends from the inner end of the suture posterior to the arcs through the ocellus to the base.

The female posterior margin of the seventh sternite is angularly produced. Male plates elongate tapering to pointed apices. The style is long scarcely narrowed at apex and bluntly rounded. The ædeagus consists of an erect caudal portion which is broad in lateral view with a sharp pointed erect spine-like structure on either side at about middle which is as long as the broad portion and proximal to it on each side. The cephalad portion is composed of a pair of broad structures which are some distance apart.

This is the common eastern form and extends west of the Mississippi River, probably to the Rocky Mountains in certain states.

The larger size and internal genital structures will easily sep arate it from the western species.

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* Entomologist, California Agricultural Experiment Station, Berkeley.

Neokolla severini DeLong, new species

In form and coloration resembling *gothica* but smaller, and with a blunter head and with distinct male genital structures. Length 5.5 to 6 mm.

Vertex produced and bluntly angled, almost one third wider between the eyes than the median length.

Color similar to that of *gothica*. The vertex ground color is grayish often tinted with reddish. There is a black spot at the apex. There is an area on each margin about half way between the apex and the eye, separated from the disc by a black line and which encloses several dark arc-like lines. A black line extends from the inner basal margin of this area to the ocellus which is enclosed in a black ring. A black line extends forward from the ocellus, curves on the disc to meet the curved line from the opposite side, from which point they are directed basally for a short distance as contiguous lines. There is also a black dash near the base on either side between the ocellus and the eye. The anterior third of the pronotum is pale with black markings. The posterior two thirds is black. The scutellum is gray, often tinted with red, with black lines extending from either side at about the middle to the pronotum. The elytra are usually dark with a few pale markings, and the veins are inconspicuous, often obscured. The face is pale with traces of faint arcs.

The posterior margin of the seventh sternite strongly angularly produced to a blunt apex. Male plates elongate, concavely narrowed on the inner margins to form narrow rather blunt apices. Plates about four times as long as the width of each at base. Styles rather short, broad at base and curved inwardly to form a blunt apex, Aedeagus simple, in ventral view the apex appears slightly enlarged and notched at middle forming two rounded apical lobes. At the base is a pair of dorsally directed processes.

Holotype male and allotype female and male and female paratypes collected at LARKMEAD, in SONOMA COUNTY, CALIFORNIA, from periwinkle or running myrtle (*Vinca minor*) during 1947 by Dr. H. H. P. Severin. A series of male and female paratypes are at hand collected at Oak Creek Canyon, Arizona, August 1 and 15, 1938; Chiricahua Mts., Ariz., Sept. 14, 1938; Huapai Mts., Ariz., July 6, 1938; Huachuca Mts., Ariz., July 20, 1937; Flagstaff, Ariz., July 30, 1938; Congress Jct., Ariz., June 14, 1937; all by D. J. and J. N. Knull.

For many years this species has been identified as *gothica*. I take pleasure in dedicating it to Dr. Severin who has performed so much excellent work upon plant disease transmission

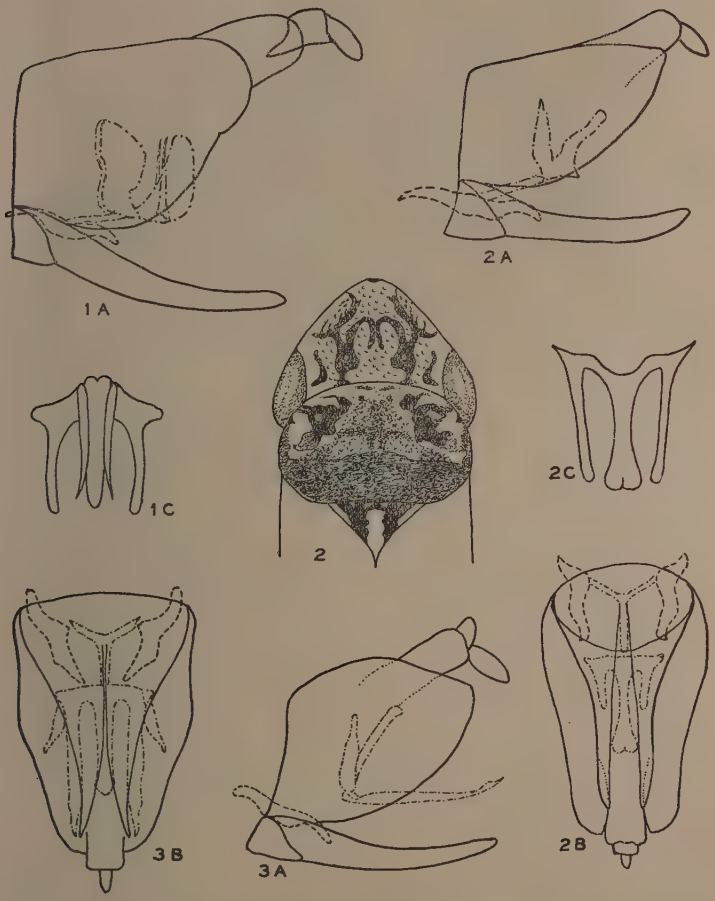

Fig. 1a. *Neokolla gothica*, lateral view of male genetalia; 1c. caudal view of ædeagus. Fig. 2. *Neokolla severini*, dorsal view of head, pronotum and scutellum; 2a. lateral view of male genitalia; 2b. ventral view of male genitalia; 2c. caudal view of ædeagus. Fig. 3a. *Neokolla aridella*, lateral view of male genitalia; 3b. ventral view of male genitalia.

by insect vectors. This species he has discovered is a vector of the virus of Pierce's disease of grapevines and alfalfa dwarf.

Neokolla aridella DeLong, new species

Resembling *gothica* in form and appearance but a little smaller and with distinct male genital structures. Length, male 5mm.

Vertex bluntly, angularly produced, about two thirds as long at middle as the basal width between the eyes.

Color vertex, anterior portion of pronotum, and scutellum tawny marked with black; posterior portion of pronotum and elytra gray. The vertex has a black spot at the apex surrounded by a pale ring, the reflexed portion is heavily marked with black and a black line extends from the inner end of the impressed groove through the ocellus to base. The two black loops or "horseshoes" usually found on the basal portion are fused on the inner margin so as to form a median black longitudinal line on the basal two thirds. The anterior portion of the pronotum is rather heavily marked with black. The scutellum appears mostly black, with tawny margins, a few spots at base and a conspicuous median apical spot on apical half. Elytra dark gray with pale veins on apical portion. Face black with white mottling.

The posterior margin of the seventh sternite of the female is strongly produced, sloping on each side to form a blunt angle at apex. The male plates are long, concavely tapered on outer margin to form narrow, pointed apices. The styles are rather short and the apices are bluntly pointed. The ædeagus is composed of a pair of long blade-like processes that extend caudally. These are well separated and are sharp pointed. At the base of these structures is a pair of erect processes which are shorter and extend dorsally. Between these is a single media process which extends dorsally and slightly caudally and appears to attach to the margin of the anal tube.

Holotype, male, collected at the CHIRICAHUA MTS., ARIZONA, Sept. 9, 1935 by F. H. Parker. Allotype female and male and female paratypes collected at Tasquillo, Hidalgo, Mexico (K-174) October 30, 1945, by DeLong, Hershberger and Elliott; also same locality October 29, 1941, by Good and DeLong. Paratype male collected at Cave Creek, Arizona, Chirichua Mts., Arizona, Sept. 16, 1935, by F. H. Parker (specimen loaned by R. A. Flock).

ARRENOCLAVUS, A NEW GENUS OF POLYEMBRYONIC ENCYRTIDAE

(Hymenoptera)

BY RICHARD L. DOUTT[1]
Division of Biological Control
University of California

Blanchard (1940) published a key to some Argentine encyrtids including one new species of *Copidosoma* designated as *koehleri*. Although no formal description accompanied the key, the specific name is valid and has been used by various authors in discussing the biology, distribution, and economic importance of this insect. On the basis of a careful morphological analysis of all stages of *koehleri* it is believed that the characters exhibited by this species preclude its proper inclusion within the defined limits of any currently valid genus, and therefore it seems advisable to designate a new genus.

Arrenoclavus Doutt, new genus

Female. Length 1.1 mm. to 1.6 mm., average 1.29 mm. Head only slightly longer than broad in a ratio of 27:25. Eyes oval, nonhispid, cheeks long. Mandibles tridentate at apex with a fourth small tooth on inner surface, two prominent setæ present on distal half. Maxillary palpi 4 segmented, labial 3. Antennæ inserted near border of mouth. Scape elongate, cylindrical, reticulate; pedicel longer than broad, longer than following segment; funicle filiform, funicle segment 1 the smallest antennal segment, funicle segments 2 - 6 subequal in length; club three segmented, wider than funicle, truncate at apex (Fig. 1). Antennæ black.

Scutum rather coarsely punctuate, sparsely clothed with regularly arranged fine setæ. Scutum large, entire, convex. Axillæ contiguous at apex. Scutellum rounded at apex, distinctly shield shaped, sparsely covered with fine setæ. Thorax black with iridescent purplish sheen except scutum, which is black with a greenish luster.

Abdomen subtriangular, shiny black. Ovipositor exserted for length equal to basitarsus of posterior leg.

Anterior legs black, but tibial spurs, tarsi, and bases of tibiæ fuscous. Middle legs black, except tips of femora, bases of tibiæ, saltatorial tibial spurs, and first 3 tarsal segments which are pallid.

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[1]Junior Entomologist in the Experiment Station.

Posterior legs black, except for pallid bases of tibiæ and brown tarsi.

Anterior wings large, broad, hyaline; submarginal vein of normal length; marginal vein very short; postmarginal vein bearing a large, prominent seta; postmarginal vein longer than marginal. Stigmal vein longer than marginal and post-marginal combined, slightly enlarged at apex; cluster of 4 round white spots near apex (Fig. 2).

Male. Average length 1.62 mm., range 1.02 mm. to 1.88 mm. (from 652 individuals). In color and habitus similar to female. Antennal scape elongate, narrower at apex than at base; pedicel smaller than any funicle segment; funicle more setaceous than that of female, funicle joints subequal in size, somewhat wider than

Fig. 1. Antennæ of *Arrenoclavus koehleri* (Blanchard).

pedicel; club lanceolate, no wider than funicle segments, divided by transverse septum (Fig. 1).

Egg. Unbanded, no modification of chorion for respiration, dumbbell-shaped, consisting of micropylar bulb, stalk, and enlarged basal portion.

Polygerm. Staphyloform or embryos in spherical cluster, not in embryonic chain as *Copidosoma;* associated with host's fat body and tracheæ.

Asexual larvae. Normally only one produced per polygerm. Somewhat nematode-like in appearance.

Sexual larvae. Hymenopteriform, 13 segmented, 9 pairs of spir-

acles. The two lateral ileac glands (Flanders 1938) attach anteriorly to the labial glands, and are contiguous with the labial glands over posterior portion. Lateral ileac glands of *Copidosoma* are not contiguous over the posterior portion. (Parker 1924).

Figure 2.

A. Anterior wing of *Arrenoclavus koehleri* (Blanchard). B. Details of stigmal section.

The truncate antennal club and broad, subtriangular abdomen separate the female *Arrenoclavus* from the typical *Copidosoma* female (*C. boucheanum Ratz.*) which possesses a lanceolate club and an abdomen so strongly compressed that the dorso-ventral aspect is almost lost in the prominent lateral surfaces.

The presence of a transverse septum in the club of the male antenna separates *Arrenoclavus* from the males of allied genera (*Copidosoma, Litomastix, Paralitomastix*) which have solid clubs. The two-segmented nature of the male club is easily seen when specimens are treated with 95% alcohol, immersed in clove oil, and then mounted in balsam with the lateral antennal surfaces toward the observer. This character is not readily evident in tag mounted individuals nor in those slide mounted specimens which present other than the lateral antennal surfaces to the observer. Since the lateral surface is usually visible without manipulating the specimen in the balsam, the club's septum is ordinarily seen in the majority of slide mounted specimens. For instance 127 male *koehleri* were placed at random in balsam without any effort being made to adjust their appendages, and of this large series 102 individuals unmistakably disclosed the characteristic club of *Arrenoclavus* while it was difficult to see this character in only 25 specimens. The generic name is derived from the unique character of the male antennal club.

Arrenoclavus may be further distinguished from other genera by characters present in the wing venation and in the developmental stages.

Genotype. *Copidosoma koehleri* Blanchard

A series of specimens upon which this description is based is deposited in the collection of the Division of Biological Control of the University of California. A similar series is to be deposited in the collection of the California Academy of Sciences.

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THE GENUS EUPARAGIA IN NORTH AMERICA
(Hymenoptera, Vespidæ, Euparagiinæ)

BY RICHARD M. BOHART
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The genus *Euparagia* has been known from three species of small, stout, masarid-like wasps from northern Mexico, New Mexico, California and Nevada. Since publication of a synopsis on the genus (R. Bohart, Pan-Pac. Ent. 14:136-139, 1938) considerable additional material has been examined which has extended the known range of the genus to include Arizona and Texas, and has added three species which are described below. Much of the new material was sent to me by P. H. Timberlake, some of it was personally collected, and the remainder was collected by E. C. Van Dyke, J. Bequaert, E. G. Linsley, A. T. McClay and F. T. Scott.

KEY TO EUPARAGIA FEMALES

1. Head with 4 shiny swellings across vertex ..... *maculiceps* (Cameron)
– Head without shiny swellings across vertex 2
2. Propodeum all black ..... *scutellaris* Cresson
– Propodeum partly or entirely reddish 3
3. Antennal flagellum black except for an obscure row of reddish spots beneath; body about 7.0 mm. long ..... *boregoensis* R. Bohart
– Antennal flagellum all reddish or with brownish above 4
4. Propodeum marked with dark red ..... *platiniceps* R. Bohart
– Propodeum marked with light red 5
5. Lateral ocellus separated by nearly twice its diameter from compound eye; body about 7.0 mm. long; abdomen black, red and ivory ..... *desertorum* R. Bohart
– Lateral ocellus separated from compound eye by about its diameter; body 4.5 - 6.0 mm. long; abdomen red and yellowish ivory ..... *timberlakei* R. Bohart

KEY TO EUPARAGIA MALES

1. Head with 4 shiny swellings across vertex ..... *maculiceps* (Cameron)
– Head without shiny swellings across vertex 2
2. Front femur with a pronounced knob at the base 3
– Front femur without a pronounced knob at the base 5

3. Knob of front femur narrow, sharp, somewhat double, surpassed by projection of trochanter; markings ivory and black, antennal flagellum yellowish beneath, brown or black above..... .....*scutellaris* Cresson
– Knob of front femur with a knife-like edge, obtuse, not surpassed by projection of front trochanter; propodeum and abdomen with some reddish markings at least..... 4
4. Antennal flagellum entirely black or very dark brown, last segment incurved beneath in profile; propodeum dark except for reddish near abdominal insertion.....*boregoensis* R. Bohart
– Antennal flagellum light red beneath, dark red or reddish brown above, last segment slightly outcurved beneath in profile; propodeum usually extensively reddish.....*desertorum* R. Bohart
5. Front femur with an obtuse angle toward base beneath; abdomen black, brownish red and ivory; eyes grey; lateral ocellus separated by slightly more than its diameter from compound eye.....*platiniceps* R. Bohart
– Front femur evenly rounded toward base beneath; abdomen red and yellowish ivory; eyes greenish grey; lateral ocellus separated by slightly less than its diameter from compound eye.....*timberlakei* R. Bohart

Euparagia timberlakei R. Bohart, new species

Male. Black, extensively marked with light red and yellowish ivory, eyes greenish grey. Yellowish ivory are: mandible mostly, clypeus, spot on scape, dot near hind ocellus, pronotum and tegula mostly, parategula, mesopleural spot, square mesonotal spot, scutellum except for emarginate basal black area, tibiæ and tarsi mostly, femora apically, emarginate apical bands on abdominal tergites and traces on sternites. Light red are: pedicel and flagellum, lower half of propodeum, femora mostly, tibiæ and tarsi partly, basal portions of abdominal tergites except at extreme base of I (red occupies more than half of I and II), sternites mostly. Wings transparent, hyaline. Pubescence thick and silvery on face and mesopleuron. Antenna stout, clavate, third segment shorter than diameter of tenth segment, last segment cone-shaped, not incurved below, about as long as broad at base and pointed at tip; clypeus bidentate and deeply cleft at apex; lateral ocellus removed by less than its diameter from compound eye. Propodeal concavity not limited by a superior ridge; front femur similar in shape to mid femur, broadly rounded toward base; front trochanter with a slender process which is about as long as seventh antennal segment. Seventh sternite with a median groove, apical margin slightly incurved. Length of body to apex of second tergite 5.0 mm.

Female. Markings about as in male except as follows: mandible mostly red, clypeus black except for red tip, scape dark. Clypeus minutely bidentate at apex. Length of third antennal segment

about as great as that of tenth but only about two-thirds as great as width of tenth. Lateral ocellus removed by about 1.2 diameters from compound eye.

Holotype, male, Calif. Acad. Sci., Ent., No. 5994, 6 miles west of PANAMINT SPRINGS, INYO CO., CALIFORNIA, on *Eriogonum trichopodum*, June 5, 1939 (R. M. Bohart). Paratypes, 3 males and 4 females, same data as type; 2 males and 4 females, same data as type, 2 males and 4 females, near Palm Springs, Riverside Co., California, on *Eriogonum trichopodum*, June 8 to June 28 (P. H. Timberlake, E. C. Van Dyke); 1 male Lone Pine, Inyo Co., California, June 13, 1937 (E. C. Van Dyke); 1 male, Lee Canyon, Mt. Charleston, Nevada, May 25, 1940 (G. E. Bohart); 1 male and 2 females, Beaver Dam, Arizona, on *Eriogonum trichopis*, June 20, 1939 (P. H. Timberlake). Paratypes have been placed in the collections of the U. S. National Museum, California Academy of Sciences, University of Kansas, Museum of Comparative Zoology at Harvard, American Museum of Natural History, P. H. Timberlake and the writer.

The narrowed frons, indicated by the proximity of the ocelli to the compound eyes, is diagnostic for this species. Also, it is the only one known with green eyes. The species is named for P. H. Timberlake who has generously turned his relatively large collection of *Euparagia* over to me for study.

Euparagia desertorum R. Bohart, new species

Male. Black, marked with reddish and ivory, eyes gray. Ivory are: mandible mostly, clypeus except narrowly at sides, spot on scape, dot near hind ocellus, pronotum mostly, mesopleural spot, tegula mostly, square mesonotal spot, broad hind margin of scutellum, lateral propodeal dot, tibiæ and tarsi mostly, femora at apex, broad emarginate apical bands on abdominal segments comprising about two thirds of visible tergal area. Brick red are; mandible apically, flagellum mostly but darker above, tegular spot, small spots on propodeum below, femora largely (black at base), tibiæ and tarsi partly, abdominal tergite I at side, emarginations of tergites I to VII (base of I to III black). Wings transparent, hyaline. Pubescence thick and silvery on face and mesopleuron. Antenna somewhat clubbed, third segment curved above, straight below, pointed at tip; clypeus bidentate and deeply cleft at apex; lateral ocellus removed by about 1.5 times its diameter from compound eye. Propodeal concavity not limited by a superior ridge; front femur with a ridged basal protuberance (a little less prominent than in *boregoensis*) and a slight swelling at apical two-thirds;

front trochanter with a curved and flattened process which is a little longer than seventh antennal segment. Seventh sternite nearly flat, apical margin practically straight. Length of body to apex of second tergite 7.0 mm.

Female. Markings about as in male except as follows: mandible mostly red, lower half of clypeus black, upper half ivory, scape black, pronotum partly red, propodeum almost entirely red, mid and hind femur mostly red, abdominal tergite I with connected median and lateral red spots, venter mostly reddish and brown. Clypeus minutely bidentate at apex. Length of third antennal segment slightly greater than that of tenth and as great as the width of tenth. Lateral ocellus removed by about 2 diameters from compound eye.

Holotype, male, Calif. Acad. Sci., Ent., No. 5995, 1000 PALMS, SAN BERNARDINO CO., CALIFORNIA, on *Eriogonum reniforme*, April 10, 1937 (P. H. Timberlake). Paratypes, 2 males, same data as type; 1 pair, 13 miles east of Needles, San Bernardino Co., California, on *Eriogonum inflatum*, June 5, 1938 (P. H. Timberlake). 1 male, Mohave, Kern Co., California, June 8, 1938 (F. T. Scott). Paratypes have been placed in the collections of the U. S. National Museum, Museum of Comparative Zoology at Harvard, P. H. Timberlake, and the writer.

This species is closely related to *boregoensis* as indicated by the structure of the front femur in the male. The principle differences are in color and in the male antennæ which are stouter in *desertorum*.

Euparagia boregoensis R. Bohart, new species

Male. Black, marked with ivory and some dark reddish, eyes dark grey. Ivory are: basal two thirds of mandible, large central area of clypeus, dot on scape, dot near hind ocellus, pronotum partly (a large black spot in front of tegula), dot on tegula, parategula minutely, mesopleural spot, mesonotal spot, spots at apex of femora and tibiæ, tarsi mostly, convex apical bands on abdominal tergites attached to large lateral spots. Dark reddish are: mandible toward apex, clypeal teeth, tegula mostly, propodeum near attachment of abdomen, legs partly, lateral spot on abdominal tergite I, spot on VI. Venter of abdomen brownish and brownish red, traces of ivory on II and III. Wings transparent, hyaline. Pubescence moderately thick and silky on clypeus and front, fairly dense and silvery on mesopleuron. Puncturation as in other members of genus, moderate and close, granular on clypeus. Antenna relatively slender, third segment distinctly longer than diameter of tenth segment, last segment slightly incurved below, about 1.5

times as long as its basal diameter and bluntly rounded at tip; clypeus bidentate and deeply cleft at apex; lateral ocellus removed by 1.5 times its diameter from compound eye. Propodeal concavity not limited by a superior ridge; front femur with a prominent, ridged basal protuberance and a swelling at apical two-thirds, front trochanter with a curved and flattened process which is about as long as seventh antennal segment. Seventh sternite nearly flat, apical margin slightly outcurved. Length of body to apex of second tergite 7.0 mm.

Female. Markings about as in male except as follows: mandible mostly red, clypeus black with a transverse basal ivory spot, pronotum with a large red spot, propodeum largely red, mid and hind femora mostly red, tergite I with reddish extending across middle. Clypeus minutely bidentate at apex. Length of third antennal segment greater than that of tenth and as great as width of tenth. Lateral ocellus separated by a little more than 2 diameters from compound eye.

Holotype, male, Calif. Acad. Sci., Ent., No. 5996, BOREGO VALLEY, SAN DIEGO CO., CALIFORNIA, on *Eriogonum*, April 5, 1940 (R. M. Bohart). Paratypes, 1 male and 1 female, some data as type but collected April 8, 1939. Paratypes are in the writer's collection.

This species is close to *desertorum* but much darker and with more slender antennæ, especially in the male. The type series was collected on a rocky outcropping about five miles south of the Borego Post Office.

EUPARAGIA PLATINICEPS R. Bohart

Euparagia platiniceps R. Bohart, 1938. Pan-Pac. Ent. 14:318. Male.

Male (additional characters): Antenna yellowish beneath, third segment longer than tenth, its length as great as width of tenth; lateral ocellus removed by slightly more than 1 diameter from compound eye. Apical margin of seventh sternite not incurved at middle.

Female (previously undescribed): Markings about as in male except as follows: mandible mostly red, clypeus black except for red tip, propodeum largely brownish red, abdominal marks ivory and brownish red, latter somewhat more extensive than in male. Lateral ocellus separated by 2 diameters from compound eye.

Records: California: 2 males, Lone Pine, Inyo Co., (type locality), June, 1937, (N. W. Frazier); 1 female, Brown, Inyo Co.,

on *Eriogonum*, June 11, 1942 (R. M. Bohart); 4 males and 1 female, 1000 Palms, San Bernardino Co.; on *Eriogonum reniforme*, April 10, 1937 (P. H. Timberlake); 2 males and 2 females, near Palm Springs, Riverside Co., on *Eriogonum*, *Euphorbia* and *Croton*, April, May and June (P. H. Timberlake, R. M. Bohart); 1 female, near Edom, Riverside Co., on *Larrea*, April 12, 1937 (E. G. Linsley).

Euparagia scutellaris Cresson

Euparagia scutellaris Cresson, 1879. Proc. Acad. Nat. Sci., Phila., Ent. Sec. 6:6. male, female (monobasic genotype).

Euparagia maculifrons Bradley, 1922. Univ. Calif. Pub. Ent. 1:384. In error.

Old Records: California: Lake Tahoe; Sobre Vista, Sonoma Co.; Mt. Diablo; Yosemite; Santa Cruz Mts.; Santa Clara Co.; Palo Alto; Kaweah, Tulare Co.; Claremont. Nevada (type locality).

New Records: California: 1 female, Davis Creek, Modoc Co., July 17, 1922 (C. L. Fox); 1 male, Glen Ellen, Sonoma Co., May 19, 1938 (A. T. McClay); 1 male, El Portal, Mariposa Co., May 18, 1938 (R. M. Bohart); 1 pair, Paraiso Springs, Monterey Co., May and June (L. S. Slevin); 1 pair, near Coalinga, Fresno Co., June 8, 1941 (R. M. Bohart); 1 male, near Newhall, Los Angeles Co., April 20, 1940 (R. M. Bohart).

Euparagia maculiceps (Cameron)

Plesiomasaris maculiceps Cameron, 1904. Trans. Amer. Ent. Soc. 30:267. Male.

Odynerus simplicipes Cameron, 1905. Trans. Amer. Ent. Soc. 31:380. Male.

Odynerus vicarius. Schulz, 1906. Spolia Hymenopterologica, p. 219. New name for *simplicipes* Cameron.

Psiloglossa simplicipes Rohwer, 1909. Ent. News 20:357. Female.

Old Records: New Mexico: Las Cruces; Mexico: Guerrero (type locality).

New Records: Arizona: two females, Tucson, July 25, 1940 (J. Bequaert); Texas: females, Knippa, July 3-6, 1910 (F. C. Pratt).

NEW SPECIES IN THE GENUS *EUCERCERIS* WITH NOTES ON RECORDED SPECIES AND A REVISED KEY TO THE GENUS

(Hymenoptera: Sphecidæ)

BY H. A. SCULLEN

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Since publication of the writer's "A Review of the Genus *Eucerceris*"[2] in 1939, several undescribed forms have come to his attention. Some of these new species have been collected by the author on his trips into the southwestern desert country, while others have been received through the kindness of other collectors and institutions. Additional information has been secured relative to established species and this is included. A new key to the genus has been prepared to embody the new species here described and to correct certain errors which have appeared in the former key. Future field studies on the biology of the genus may show that some of these new forms are male and female of the same species.

The wing venation nomenclature here used is that of Cresson. (Trans. Amer. Ent. Soc. 1887 Suppl. Vol., p. 5.)

REVISED KEY TO EUCERCERIS

Seven segments in abdomen.....males
Six segments in abdomen.....females

MALES

1. Second submarginal cell not petiolate..... 2
– Second submarginal cell petiolate.....20
2. No rows of erect bristles on venter.....*flavocincta*
– One or more rows of erect bristles on venter..... 3
3. Row of bristles on fifth sternite only, sometimes very inconspicuous..... 4
– More than one row of bristles on venter.....11
4. Second femora with a deep depression bordered with a row of long hairs; two inconspicuous clusters of bristles on sternite 5.....*lacunosa*
– Second femora normal..... 5
5. Thorax covered with a dense layer of short setæ giving a distinct velvet appearance.....*velutina*
– Setæ of thorax normal..... 6

[1]These investigations are financed largely by grants for General Research administered by the Graduate School, Oregon State College. Published with the approval of the Monographs Publication Committee, Oregon State College. Research paper No. 126.

[2]Additional material belonging to the genera *Cerceris* and *Eucerceris*, especially from the southwest and Mexico, will be most welcome for study. Information is also needed on the biology of the group.

6. Yellow vittæ of face fusing above antennæ ..... *arenaria*
– Yellow vittæ of face not fusing above the antennæ 7
7. Dark vittæ of face extend onto clypeus 8
– Dark vittæ do not extend beyond the dorsal clypeal border, except for a hairline between clypeal lobes 9
8. Very short (not over one eighth as long as the sternite is wide) broken row of bristles on fifth sternite ..... *melanosa*
– Row of bristles on fifth sternite about one third as long as sternite is wide ..... *melanovittata*
9. Row of bristles about one fourth as long as sternite is wide; thorax conspicuously hairy with long setæ ..... *mellea*
– Row of bristles from one third to one half as long as sternite is wide; setæ of thorax short and inconspicuous 10
10. Row of bristles about one third as long as the sternite is wide; considerable amber on various parts of body ..... *rubripes*
— Row of bristles about one half as long as the sternite is wide; body color black and yellow ..... *fulvipes*
11. All three rows of bristles subequal in length of bristles and length of rows 12
— Row of bristles on fifth sternite either much shorter or different in form from other rows 14
12. Each row of bristles distinctly separated into two parts *zonata*
Bristles in undivided rows 13
13. Length about 15 mm.; no yellow stripes on mesoscutum *superba*
— Length about 10 mm.; two short yellow stripes as a rule on mesoscutum ..... *triciliata*
14. Distal row of bristles only slightly shorter than the others but bristles waxed into a compact layer and shorter than the others 15
— Distal row of bristles hardly distinguishable or at least very short 16
15. Ten to twelve mm. in length; black and yellow ..... *insignis*
— Fifteen or more mm. in length; considerable amber *canaliculata*
16. Yellow of face fused above the antennæ 17
— Yellow of face not fused above antennæ except in rare individuals 19
17. Anterior ridges of tergites black or with broken yellow bands ..... *pacifica*
— All tergites presenting solid wide bands of yellow 18
18. Markings creamy white ..... *elegans*
— Markings yellow ..... *hespera*
19. Enclosure black; immaculate and deeply ridged subparallel to base; mesal borders of eyes subparallel; black with cream colored markings ..... *baja*
— Enclosure with oval yellow patches and almost smooth; mesal borders of eyes converging dorsad; black with yellow markings ..... *similis*
20. Mandibles abnormally large; rows of erect bristles on sternites 3 and 4, inconspicuous cluster on 5, somewhat hidden by long

setæ ..... *montana*
— Mandibles normal 21
21. Scape wide and flattened; projections on posterior distal angles of first five segments of the flagellum; rows of erect bristles on sternites three and four, inconspicuous cluster on five ..... *angulata*
— Antennæ normal in form, long row of erect bristles on sternite five closely packed 22
22. Abdomen with ferruginous ..... *tricolor*
— Abdomen black and creamy yellow, no ferruginous ..... *vittatifrons*

FEMALES

1. Second submarginal cell not petiolate 2
– Second submarginal cell petiolate 6
2. With no distinct projection or extension on the ventral clypeal border or surface, except for a slight medial carina; ferruginous with yellow markings ..... *arizonensis*
– With a conspicuous projection or extension on the ventral clypeal border or surface 3
3. Clypeal surface with an emarginate projection on the surface of which are two subparallel carina; brown with depressions black ..... *brunnea*
– Ventral clypeal border with a rounded medial extension; black with yellow markings 4
4. Mandibular teeth acute; with a large amount of fulvous to ferruginous coloring ..... *velutina*
– Mandibular teeth rounded and not acute; black with yellow markings only 5
5. Length about 23 mm. ..... *violaceipennis*
– Length about 15 mm. ..... *punctifrons*
6. Distinct projections or elevations on the surfaces of the medial or lateral lobes of the clypeus 7
– Without distinct projections or elevations on the surfaces of the medial or lateral lobes of the clypeus 13
7. Distinct projections or elevations on the surfaces of the lateral lobes only 8
– Distinct projections or elevations on the surface of the medial lobe only 10
8. Projections on the lateral lobes of the clypeus in the form of low conical protuberances; about 10 mm. in length ..... *biconica*
— Projections on the lateral lobes of the clypeus in the form of high dentate processes; about 15 mm. or more in length 9
9. Ferruginous with yellow markings ..... *canaliculata*
– Fuscous to black with yellow markings ..... *canaliculata* var. *atronitida*
10. Body black with cream colored markings; black vittæ extending to apical clypeal border ..... *arenaria*
— Body largely ferruginous, yellow and black; black vittæ not extending to apical clypeal border 11

11. Mandibles with two distinct teeth ..... *conata*
— Mandibles with a single small denticle 12
12. Clypeal process in the form of an acute projection ..... *rubripes*
— Clypeal process in the form of a low, rounded, cone-shaped elevation ..... *mellea*
13. Apical clypeal border with one large process 14
— Apical clypeal border with more than one process and these relatively small 20
14. Process on clypeal border acute 15
— Process on clypeal border not acute 17
15. Mandibles with one large, triangular, obtuse tooth somewhat divided ..... *zonata*
— Mandibles with one single pointed tooth 16
16. Abdomen largely yellow ..... *superba*
— Abdomen ferruginous proximally, black distally ..... *superba* var. *bicolor*
17. Clypeal process truncate, distal border of process sinuate ..... *sinuata*
— Clypeal process broadly rounded 18
18. Lateral angles of pronotum dentate ..... *angulata*
— Pronotum not dentate 19
19. Enclosure transversely striated ..... *cerceriformis*
— Enclosure pitted ..... *montana*
20. Two processes on the apical region of the clypeus 21
— More than two processes on the apical region of the clypeus 23
21. Clypeal processes truncate and not widely separated *bitruncata*
— Processes pointed and widely separated 22
22. Pygidial area narrower at the proximal end than in the middle; without rufous on the abdomen ..... *vittatifrons*
— Pygidial area sub equal at the proximal end and in the middle; rufous on the first three or more abdominal segments ..... *tricolor*
23. One undivided tooth on the mandible 24
— Two single or one divided tooth on the mandible 27
24. No distinct processes on the clypeus below the distal border 25
— One or more small denticles or projections on the clypeus below the distal border 26
25. Four processes on the distal clypeal border about equal in size and equally spaced ..... *fulvipes*
— Two pairs of processes on the distal clypeal border widely separated ..... *insignis*
26. Two widely separated, divided, acute teeth and one minute, medial denticle on the clypeal border; two medial denticles on the clypeus below the border; enclosure deeply ridged; 15 mm. or more in length ..... *flavocincta*
— Two widely separated, undivided teeth and a pair of medial denticles on the clypeal border; a medial pair of denticles on

the clypeus below the border; ridges of enclosure very inconspicuous; length about 10 mm. ..... *similis*

27. Yellow of abdomen not forming complete bands; body almost completely ferruginous ..... *ferruginosa*

— Yellow of abdomen forming complete bands on first five tergites 28

28. Two truncate projections on the clypeal border between which is a cluster of long bristles; below the bristles is a bilobed process ..... *elegans*

— Two widely separated, acute projections on the clypeal border between which lies a broad truncate process with an uneven margin ..... *ruficeps*

GROUP A

Second submarginal cell of the forewing not petiolate in either sex

EUCERCERIS LACUNOSA Scullen

Additional records: Arizona: 2 males, 35 mi. e. of Douglas, 4600 feet elevation, August 1, 1946 (H. A. S.)[1]; male, Ramsey Canyon, Huachuca Mts., 5400 feet elevation, July 28, 1946; male, Tucson, 2400 feet elevation, August 17, 1946.

Eucerceris brunnea Scullen, new species
Figs. 1A, B, C; 13

A very distinctive species easily recognized by its large size and almost entirely brown color, as well as other structural differences.

Female. Length 21 mm. Head closely pitted, clothed with amber hairs; mandibles with a large triangular bicuspid tooth, ferruginous with black tips and denticles; clypeus very broad and short with a medial process slightly emarginate on the dorsal surface of which are two subparallel carina and with a cluster of long bristles below, surface hairs long and silvery; antennæ normal in form, ferruginous with more or less black on the distal half; front wide, ferruginous with black of the vertex extending through the antennal scrobes to and along the dorsal border of the clypeus; vertex black; occiput and genæ ferruginous.

Thorax very closely pitted, clothed with amber hairs, which are very short on the notum becoming longer distally and ventrally; dorsum ferruginous becoming black along the sutures; pleuron and venter largely black; enclosure deeply and closely pitted with a medial groove; legs ferruginous; wings subhyaline with a clouded area extending throughout the anterior half of the forewing; sec-

[1]To save space the author will be referred to by initials only.

ond submarginal cell not petiolate (fig. 1B); second transverse-cubital vein with a distinct spur.

Abdomen normally pitted and clothed with amber hairs, ferruginous; first tergite with slight rounded elevations on the antero-lateral angles; pygidial area (fig. 1C) truncate distally, converging proximally, with a carina around the border, fringed with amber bristles.

Holotype, female, Museum of Comparative Zoology, JACALA, HIDALGO, MEXICO, 4500 feet elevation (Fig. 13), June 22, 1936, (Ralph Haag).

Eucerceris velutina Scullen, new species
Figs. 2A, B, C, D, E, F; 14

The male differs from all other species of the genus so far known by having the pronotum and mesascutum clothed with velvet-like setæ. A tooth on the mandible of the male is uncommon. The lobe-like projection on the clypeal border of the female resembles the clypeal projection on the female of *E. montana* Cresson.

Male. Length 15 mm. Head subequal to thorax in width, normally pitted, clothed with long light amber hairs becoming longer on the ventral clypeal border; mandibles with a single acute tooth, yellow with black tips and denticles; medial lobe of clypeus extended to form a short trilobed medial process; antennæ normal in form, yellow proximally becoming fulvous and fuscous distally but with the tips fulvous; front narrowing above, yellow to fulvous; vertex, occiput and genæ fuscous to black with elongated yellow to fulvous patches confluent with the lateral borders of the compound eyes.

Thorax fuscous to black with the following parts fulvous to yellow: scutellum, tegula, irregular patch on enclosure, patch on prothoracic tubercle, irregular patch back of tubercle, and a large T-shaped area on the sternum; pronotum and mesascutum clothed with velvet-like short black setae; pleuron and sternum with longer setæ; enclosure deeply pitted with a slight medial groove; prolegs and mesalegs largely yellow with some fuscous on coxæ and dorsal aspects of femora; posterior leg fuscous except ventral aspect of tibiæ and all of tarsi; wings subhyaline with the clouded area extending over the anterior two thirds of the forewing; second submarginal cell not petiolate (fig. 2E).

Fig. 1A. *E. brunnea*, ♀, face; 1B. ♀, fore wing; 1C. ♀, pygidial area. Fig. 2A. *E. velutina*, ♀, face; 2B. ♀, fore wing; 2C. ♀, pygidial area; 2D. ♂, face; 2E. ♂, fore wing; 2F. ♂, pygidial area. Fig. 3A. *E. melanosa*, ♂, face; 3B. ♂, fore wing; 3C. ♂, pygidial area. Fig. 4A. *E. melanovittata*, ♂, face.

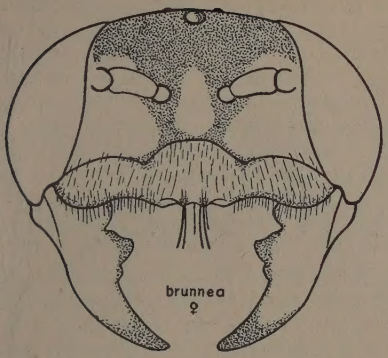


Fig. 1A

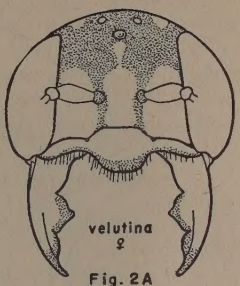


Fig. 2A

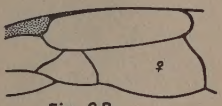


Fig. 2B

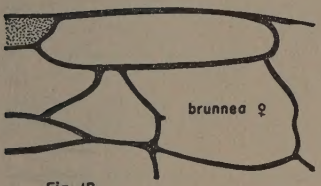


Fig. 1B

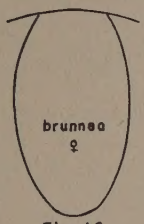


Fig. 1C

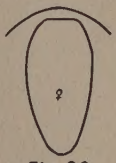


Fig. 2C

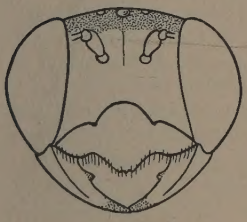


Fig. 2D

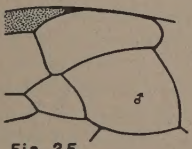


Fig. 2E

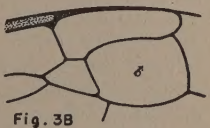


Fig. 3B

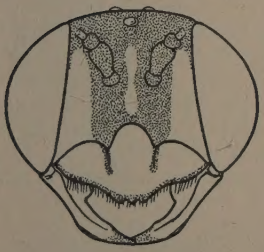
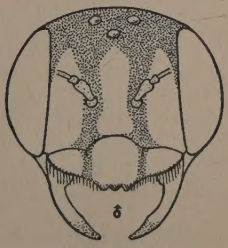


Fig. 3A

Fig. 2F

Fig. 3C



melanovittata

Fig. 4A

Abdomen sparsely pitted on convex areas and closely pitted on concave areas, sparsely clothed with short hairs dorsally but with more and longer hairs ventrally; one long row of loosely arranged bristles on sternite 5; tergite 1 black with a divided yellow band; tergites 2, 3, 4 and 5 with narrow yellow bands on the posterior borders, otherwise black except for ferruginous medial bands on tergites 2 and 3; tergite 6 yellow with a medial black area; sternite 1 black laterally, yellow medially; sternite 2 largely yellow; remainder of venter fuscous becoming more fulvous distally on sternites 5, 6, and 7; pygidial area (fig. 2F) sparsely pitted, ferruginous.

Female. Length 13 mm. Head closely pitted, clothed with short amber hairs; mandible with a large triangular tooth, yellow with fuscous tips and denticles; clypeus broad and very short, yellow except for ventral border which is fuscous, with a medial broad rounded thin process, with a few long bristles below; antennæ normal in form, yellow proximally becoming ferruginous with some medial segments darker; front yellow with fuscous vittæ extending through the antennal scrobes to the dorsal clypeal border; vertex ferruginous except for a divided yellow patch back of ocelli and a narrow line in front of ocelli; occiput and genæ ferruginous except for long curved patches of yellow confluent with the lateral borders of the compound eyes.

Thorax closely pitted except propodium; pronotum with a yellow band on the posterior border extending between and including the tubercles; mesoscutum ferruginous with two yellow stripes between and small yellow patches in front of the tegula; scutellum sparsely pitted, yellow with the borders becoming fulvous to fuscous, metanotum fulvous with the borders fuscous, propodium sparsely pitted with large yellow patches bordered by black laterally and fulvous medially and with a wide medial black band between the fulvous patches; enclosure sparsely pitted, with a central groove, yellow; pleuron fuscous to black with a yellow patch back of the tubercles; sternum black with two small yellow patches on the mesopectus and two on the mesosternum; legs yellow becoming fuscous proximally; wings similar to those of the male; second submarginal cell not petiolate. (fig. 2B).

Abdomen proximally ferruginous to fulvous becoming fuscous distally with yellow bands on the posterior ridges of tergites 2, 3, 4 and 5, divided yellow bands on the anterior ridges of tergites 3, 4 and 5; tergite 1 with a broad yellow area divided by a wedge-shaped patch of fulvous with a fuscous central patch; venter largely dark fuscous with lighter patches laterally; pygidial area (fig. 2C) deeply and closely pitted, oval in form, with a carina around the border, fringed with bristles.

Holotype, male, collection of Geo. E. Bohart, SAN BERNARDO, MEXICO, August 19, 1935, (Geo. E. Bohart). Allotype, female, Calif. Acad. Sci., Ent., same data but August 16, 1935. Paratypes,

San Bernardo, Sonora, Mexico, (Geo. E. Bohart), a male August 17, 1935, and a female, August 10, 1935. Paratypes in the author's collection.

GROUP B

Second submarginal cell petiolate in the female but not in the male

EUCERCERIS FLAVOCINCTA Cresson

The known range of this species has been greatly expanded to the northeast by one female taken at Lethbridge, Alberta, June 30, 1935, by R. W. Salt and one male taken at Wawanesa, Souris River, Manitoba, July 2, 1933, by N. A. Weber.

Eucerceris melanosa Scullen, new species
Figs. 3A, B, C; 13

The male of this species closely resembles the male of *E. flavocincta* Cresson, from which it may be separated by the short row of bristles on the 5th sternite.

Male. Length 12 mm. Head slightly wider than thorax, punctation medium, clothed with silvery hairs becoming longer on the lateral clypeal wings; mandibles nondentate, fuliginous becoming fuscous at the tip; clypeus yellow except the apical margin which is black and narrow vittæ partly separating the medial lobe from the lateral lobes, medial lobe tridentate at the apical border; antennæ normal in form, scape and pedicel fuscous, flagellum becoming darker distally; front narrowed slightly above, yellow with wide black vittæ extending through the antennal scrobes to and onto the clypeus; vertex, occiput and genæ all black except for a small round yellow spot back of the compound eye.

Thorax moderately punctate, clothed with silvery hairs, short on the notum but becoming much longer on the pleura and sternum, black except for narrow band on the posterior border of the pronotum, the metanotum, spot on the tegula and a very small spot back of the tubercle of the prothorax; enclosure deeply ridged with ridges at a 30° angle with the base, with a medial groove; femora fuscous; tibiæ yellow and fulvous; tarsi largely yellow; wings subhyaline, anterior half of forewing cloudy; second submarginal cell not petiolate. (Fig. 3B).

Abdomen normally punctate, yellow bands along the posterior border of tergites 1, 2, 4, 5 and 6, yellow band on tergite 1 broad and slightly emarginate, posterior ridge of sternite 3 fulvous to fuscous; venter largely fuscous, elongated yellow patches on sternites 3 and 4; a short divided row of bristles on the posterior border of sternite 5; pygidial area (fig. 3C) normal in form; margined by a carina and fringed with a row of bristles.

Holotype, male, University of Minnesota, TEHUACAN, PUEBLA, MEXICO, July 12, 1935, (A. E. Pritchard).

Eucerceris melanovittata Scullen, new species
Figs. 4A, B, C; 14

This species superficially resembles *fulvipes* Cr. but may be distinguished from that species by the shorter row of hairs on sternite five and the more smooth enclosure as well as characters mentioned in the key. Its markings are cream colored. In some paratypes the black vittæ of the face do not reach the ventral border of the clypeus.

Male. Length 11 mm. Head slightly wider than the thorax, moderately pitted, clothed with silvery hairs, face creamy white with black vittæ extending through the antennal scrobes to the apical clypeal border separating the lateral wings from the medial lobe of the clypeus; mandibles nondentate ferruginous becoming very dark at the tips; clypeus tridentate on the apical border of the medial lobe, silvery hairs massed along the apical borders of the lateral lobes; antennæ normal in form, fuscous to almost black distally; vertex, occiput and genæ black except for small round creamy spots back of the compound eyes.

Thorax moderately pitted, clothed with silvery hairs, black except for creamy white marks as follows: band on posterior border of pronotum, tubercles, small patch back of tubercles, patch on tegula, small lateral spots on mesascutellum, the metanotum, lateral oval patches on the propodium, the mesasternum and the metasternum; enclosure smooth except for a few scattered pits and a medial groove; legs ferruginous except for the coxæ and trochanters which are darker and for yellow spots on the coxæ, metatrochanters and the pre- and mesatibiæ; wings subhyaline with a clouded area covering the anterior third of the forewing on the distal half; second submarginal cell not petiolate (fig. 4B).

Abdomen sparsely pitted with narrow cream colored bands on the posterior ridges of tergites, 2, 3, 4, 5 and 6, tergite 1 with a broad divided band of cream; venter fuscous to black with a small cream spot on sternite 2 and broad cream colored bands on sternites 3 and 4; a short row of closely packed hairs on the posterior border of sternite 5; pygidial area (fig. 4C) typical in form.

Holotype, Calif. Acad. Sci., Ent., 25 mi. east of El Paso, Tex., July 13, (E. C. Van Dyke).

Paratypes, male, Chisos Mts., Big Bend Park, July 6, 1942 (H. A. Scullen); male, 10 mi. east of Douglas, Ariz., July 11, 1940 (E. S. Ross); male, near Marathon, Tex., July 7, 1942 (E. C. Van Dyke); male, Sierra Blanca, El Paso Co., Tex., July 8, 1917 (Jos. Bequaert); male, Mountainair, N. M., 1924 (Chas. H. Hicks); male, Ft. Davis, Tex., Sept. 6, 1943 (R. W. Strandtmann).

(Continued)